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## Congenital Cardiology Solutions

### A RETROSPECTIVE COHORT OF 100 FONTAN CONNECTIONS: RELATIONSHIP BETWEEN GEOMETRIC FEATURES AND HEMODYNAMICS OUTCOMES

Poster Contributions

Poster Sessions, Expo North

Sunday, March 10, 2013, 9:45 a.m.-10:30 a.m.

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**Background:** Fontan connections have complex and patient specific anatomies. Their geometric features can impact the hemodynamic outcomes, such as (1) connection power loss (PL), which has been shown to be related to patient exercise capacity; and (2) unbalanced hepatic flow distribution (HFD) which has been related to an increased risk of pulmonary arteriovenous malformations. In this study, a large-scale anatomic characterization of Fontan connections is performed, and results were correlated with the hemodynamic outcomes.

**Methods:** 100 patient-specific Fontan anatomies were reconstructed from axial cardiac magnetic resonance images. Geometrical parameters analyzed included: vessel diameter, shape factor (minimum / maximum diameter), angles between connecting vessels and caval offset (distance between the superior vena cava and the Fontan pathway (FP)). Computational fluid dynamics simulations were carried out using time-averaged flow boundary conditions (obtained from phase contrast magnetic resonance images) to quantify the resulting PL and HFD. Multiple regressions between the hemodynamic endpoints and the geometric parameters were investigated.  $P < 0.05$  was considered significant.

**Results:** The connection PL correlated negatively with minimum pulmonary artery (PA) diameter and minimum FP diameter ( $p < 0.001$ ). Cardiac index was found to have positive significant correlations with FP shape factor ( $p = 0.004$ ). From multiple regression, it was found that HFD correlated with caval offset ( $p < 0.001$ ), pulmonary flow distribution ( $p < 0.001$ ), connection angles ( $p < 0.001$ ), and PA diameters ( $p < 0.015$ ).

**Conclusions:** The dependence of connection PL on minimum PA and FP diameters suggests it is important to correct vessel stenosis at the connection, especially at the FP which can influence cardiac index. Also, caval offset, PA diameters and connection angles together can impact HFD. The knowledge obtained can be useful to design interventional strategies to improve connection hemodynamics in prospective cases.